

ABSTRACT

Devices such as transistors, amplifiers, frequency multipliers, and square-law detectors use injection of spin-polarized electrons from one magnetic region, into another through a control region and spin precession of injected electrons in a magnetic field induced by current in a nanowire. In one configuration, the nanowire is also one of the magnetic regions and the control region is a semiconductor region between the magnetic nanowire and the other magnetic region. Alternatively, the nanowire is insulated from the control region and the two separate magnetic regions. The relative magnetizations of the magnetic regions can be selected to achieve desired device properties. A first voltage applied between one magnetic region and the other magnetic nanowire or region causes injection of spin-polarized electrons through the control region, and a second voltage applied between the ends of the nanowire causes a current and a magnetic field that rotates electron spins to control device conductivity.